

CLAIMS

1. A current collector comprising one or more Fibre Bragg Grating sensors mounted on or in the current collector.
2. A current collector, as claimed in Claim 1, in which at least one of said Fibre Bragg Grating sensors comprises a strain grating and a compensating temperature grating combined in one unit.
3. A current collector, as claimed in Claim 1 or Claim 2, comprising a carbon collector body and a metal carrier.
4. A current collector as claimed in Claim 3, in which Fibre Bragg Grating strain gauges are situated on or within the metal carrier.
5. A current collector as claimed in Claim 3, in which the Fibre Bragg Grating strain gauges are situated on or within the carbon collector body.
6. A current collector, as claimed in any one of Claims 3 to 5, in which Fibre Bragg Grating temperature gauges are situated at the carbon collector body/metal carrier interface.
7. A monitoring system for electric vehicles drawing current from conductors, the system comprising
  - i) detector means in the collector to indicate a current collector condition and/or damage signal at a predetermined level likely to cause damage to the conductor;
  - ii) locating means operatively connected to said detector means to generate a signal indicating the location of the current collector on the conductor at which the current collector damage signal was generated.

8. A monitoring system, as claimed in Claim 7, in which the conductor is an overhead conductor, and the current collector is mounted on a pantograph.
9. A monitoring system, as claimed in Claim 8, in which the current collector damage signal is a signal initiating, or initiated by, the dropping of the pantograph head.
10. A monitoring system, as claimed in any of Claims 7 to 9, in which the current collector condition and/or damage signal is generated by wear/damage detection apparatus comprising at least one optical fibre embedded in the current collector, an optical transmitter and an optical detector.
11. A monitoring system, as claimed in any one of Claims 7 to 10 and comprising a microprocessor to analyse the output from the optical detector and capable of generating a signal describing the level of wear of the current collector.
12. A monitoring system, as claimed in any one of Claims 8 to 11 and comprising a microprocessor to analyse the output from the optical detector and capable of generating a signal to drop the pantograph from the overhead wire.
13. A monitoring system, as claimed in any of claims 7 to 12 and comprising a global positioning system ("GPS") as locating means.
14. A monitoring system, as claimed in any one of Claims 7 to 13, and comprising:
  - i. a current collector having wear/damage detection apparatus which emits a signal;
  - ii. a micro-controller which analyses the emitted signal, assesses the wear/damage of the current collector, and which can, as appropriate, produce an output to describe the level of wear or automatically to withdraw the current collector from the conductor;

- iii. a positioning system which is linked to the micro-controller and which locates the current collector at the time of said wear/damage; and
  - iv. a display unit which displays the level of wear/damage and location on the conductor of the current collector.
15. A monitoring system for electric vehicles drawing current from overhead conductors through current collectors on pantographs, the system comprising
- i) detector means in the collector to generate a signal indicative of force acting on the current collector;
  - ii) locating means operatively connected to said detector means to generate a signal indicating locations of the pantograph on the overhead conductor at which the signal indicative of force acting on the current collector exceeds a level likely to cause damage to the overhead conductor.
16. A monitoring and control system for electric vehicles drawing current from overhead conductors through current collectors on pantographs, the system comprising detector means in the collector to indicate the forces acting on the current collector, and control means to process signals from the detector means and to generate control signals for the pantograph.
17. A monitoring and control system for electric vehicles, as claimed in Claim 16, in which the pantograph is controlled such that as the force on the current collector increases, the upward force on the pantograph is decreased (or *vice versa*) so as to maintain the forces experienced by the current collector within a chosen range.
18. A monitoring and control system for electric vehicles, as claimed in any one of Claims 15 to 17, in which the detector means is a Fibre Bragg Grating strain gauge.

19. A monitoring system, as claimed in any one of Claims 7 to 18, in which a temperature sensor is incorporated in the collector and is used to generate a signal indicative of thermal overload conditions.
20. A monitoring system, as claimed in Claim 19, in which the signal indicative of thermal overload conditions is used to control the current flowing through the collector.
21. A monitoring system, as claimed in any one of Claims 7 to 20, used as an adjunct to a system in which current collector head accelerations are measured
22. A monitoring system, as claimed in any one of Claims 7 to 21, in which force measurements from the sensors are used to determine the position of the conductor with respect to a collecting face of the collector.